



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.10.2019 Bulletin 2019/42

(51) Int Cl.:
H01R 13/629 (2006.01)

(21) Application number: **18305421.2**

(22) Date of filing: **10.04.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(72) Inventors:
• **HOURY, Laurent**
27240 Le Roncenay-Authenay (FR)
• **CASSAR, Thierry**
27930 Angerville La Campagne (FR)
• **CAVAILLES, Christian**
Oceanside, CA California CA 92056 (US)

(71) Applicant: **Connecteurs Electriques Deutsch**
27000 Evreux (FR)

(74) Representative: **Grünecker Patent- und Rechtsanwälte**
PartG mbB
Leopoldstraße 4
80802 München (DE)

(54) **MATING ASSISTANCE DEVICE FOR ELECTRICAL CONNECTORS**

(57) The present invention relates to a mating assistance device (1) for electrical connectors (43, 45) comprising a housing (3) with at least one opening (9, 11) for receiving an electrical connector (43, 45), and at least one locking device (5, 7) movable between an unlocked and a locked position with respect to the housing (3), the at least one locking device (5, 7) further comprising at

least one connector pushing element (15, 17), wherein the at least one locking device (5, 7), when moved from the unlocked to the locked position, is configured such that the at least one connector pushing element (15, 17) is displaceable in the direction of insertion (A) of an electrical connector (43, 45) into the housing (3).

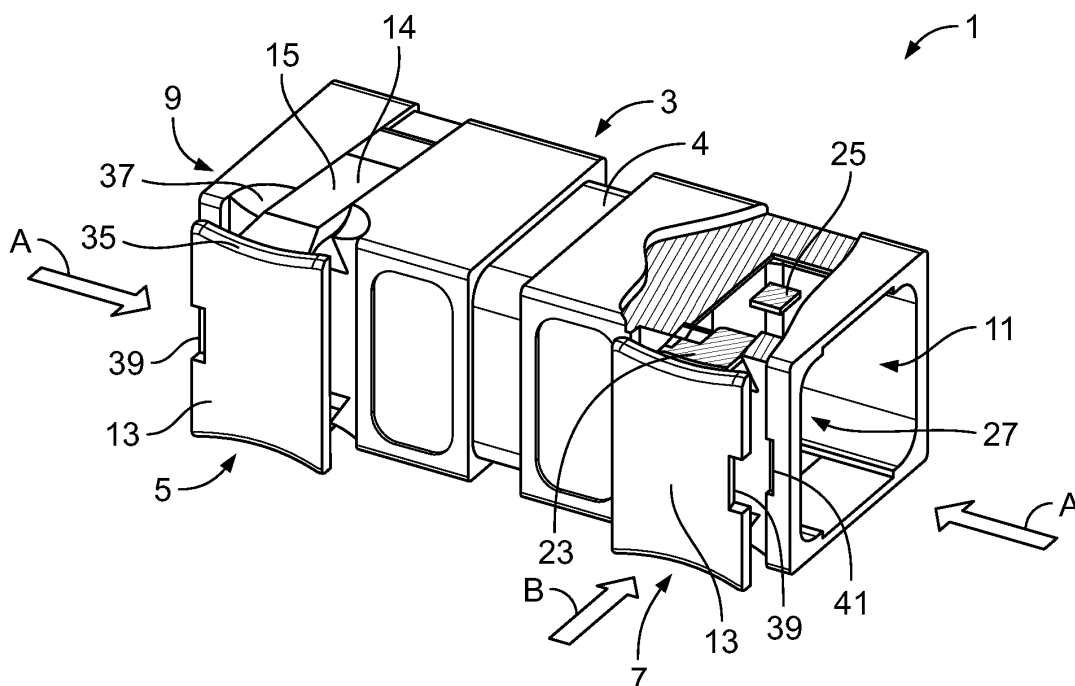


Fig. 1

Description

[0001] The present invention relates to a mating assistance device for electrical connectors and a method for connecting electrical connectors with such a mating assistance device.

[0002] Electrical connector assemblies utilized for cabin applications in commercial aerospace and other applications often comprise separate connectors that mate together to form a secure physical and electrical connection. In particular, the electrical connector assemblies for aerospace application shall meet altitude immersion requirements.

[0003] To achieve an effective, properly aligned and sealed electrical connection of the connectors, it is common to employ a mating assistance device for connecting the electrical connectors together.

[0004] The mating assistance devices known in the art are usually made of several parts which are assembled by screwing, welding and/or bonding when the connection between the connectors is achieved. Consequently, the mating assistance devices as known in the art require the use of tools, e.g. a screwdriver for the assembly. Furthermore, notwithstanding that the mating assistance device provided with machined parts are known to be a costly solution, they are also not particularly adapted in term of lightness and weight reduction for cabin applications in commercial aerospace.

[0005] Therefore, it is an object of the present invention to provide a light, easy-to-use, tool-free and inexpensive mating assistance device for a connector assembly.

[0006] The above-mentioned problem is addressed by mating assistance device for electrical connectors according to claim 1. The mating assistance device comprises a housing with at least one opening for receiving an electrical connector, and at least one locking device movable between an unlocked and a locked position with respect to the housing, the at least one locking device further comprising at least one connector pushing element,

wherein the at least one locking device, when moved from the unlocked to the locked position, is configured such that the at least one connector pushing element is displaceable in the direction of insertion of an electrical connector into the housing. Hence, the displacement of the connector pushing element between the unlocked position to the locked position allows to move the electrical connectors towards the inside of the housing. As a result, thanks to the displacement of the connector pushing element in the direction of insertion of the electrical connector, the sealing of the electrical connectors is facilitated and realized without the need of using external tools. Therefore, the assembly of the electrical connectors inside the mating assistance device is simplified and the assembly cost can be reduced.

[0007] The mating assistance device can be further improved according to various advantageous embodiments.

[0008] According to an embodiment, the trajectory of the at least one connector pushing element from the unlocked position to the locked position can be inclined with respect to the normal of the direction of insertion of the electrical connector into the housing. In particular, the trajectory of the at least one connector pushing element from the unlocked position to the locked position is inclined at an angle comprised between 5° and 15° with respect to the normal of the direction of insertion of the electrical connector into the housing. The inclined trajectory of the connector pushing element can exercise a force onto the electrical connector to move it further into the housing and to achieve the necessary sealing.

[0009] According to another embodiment, the at least one locking device can have the form of a bracket, in particular, the form of a U-shaped bracket having a configuration conforming to the shape of the housing. When using a bracket, the force can be applied on two sides of the electrical connector and in addition, the same shape of locking device can be used on the left and the right side of the housing when connecting two electrical connectors.

[0010] According to another embodiment, the U-shaped bracket can have a central portion provided with an inner surface from which extends two arms in the same direction such that the direction of the arm's length is inclined with respect to a direction extending normally from the inner surface of the central portion. The central portion can be used by the user to push the bracket from the unlocked to the locked position. By providing an inclined direction of the arms the desired movement of the connector pushing element can be obtained.

[0011] According to another embodiment, the housing can be a one-piece housing, in particular made of a molded plastic or a polymer material, and can have the shape of a hollow beam with two opened-ends for receiving a terminal of the electrical connector. The simple design of the housing and the lightweight material used provide a light device with no loose parts. In addition, the overall assembly costs can be reduced compared with a screw-together design in the art.

[0012] According to another embodiment, the at least one connector pushing element of the at least one locking device can be provided with one or more protrusions, in particular two protrusions, protruding towards the inside of the housing when in the locked position. The protrusions of the connector pushing element allow guiding and forcing the electrical connector to further move inside the housing when the locking device is moved from the unlocked position to the locked position.

[0013] According to another embodiment, the shape of the one or more protrusions of the at least one locking device can be complementary to latch means provided on an interface of the electrical connector. With the complementary shapes, an efficient transmission of the pushing force can be obtained.

[0014] According to another embodiment, the mating assistance device can further be provided with two re-

tentions means configured to hold the at least one locking device respectively in the unlocked position and in the locked position respectively relative to the housing. This feature allows preventing an involuntary locking or unlocking of the locking device, in particular during the transportation of the mating assistance device.

[0015] According to another embodiment, the retention means can be configured to provide a form-fit connection between the housing and the at least one connector pushing element in the unlocked position and in the locked position. In particular, the retentions means can comprise two recesses or grooves on the at least one connector pushing element, in particular longitudinal grooves, configured to fit to a protruding element of the housing, the protrusion element protruding towards the at least one connector pushing element. The form-fit connection in the unlocked and locked position can be realized without any external tool, and only by means of the retentions means integral with the mating assistance device. This allows simplifying the assembly step while reducing the assembly cost.

[0016] According to another embodiment, the at least one locking device and/or the housing can comprise at least one handle for pulling the locking device from the locked position to the unlocked position. Hence, the mating of the electrical connectors can be reversed, therefore allowing an easy versatile use in comparison with a soldered or a bonded assembly which have to be destroyed to disassemble the connection.

[0017] According to another embodiment, the at least one locking device and/or the housing further can comprise at least one opening with an undercut configured for allowing an unmating of the electrical connectors, in particular by using an external tool. In case a user's manual forces are not sufficient to move the locking device from the locked to the unlocked position, it still remains possible to decouple the connector again.

[0018] According to another embodiment, a center region of the housing can be provided with flanges or a flange receiving region. Thus, the device can be easily mount to other parts.

[0019] The object of the present invention is also achieved with a method for connecting electrical connectors comprising an interface provided with latch means, with the mating assistance device comprising the steps of inserting a terminal of the electrical connector into the housing via the opened-end of the mating assistance device in the direction of insertion and pushing the locking device from the unlocked to the locked position to thereby push the latch means of the electrical connector further towards the center of the housing by the connector pushing element following the inclined trajectory. With the inventive method sealed electrical connections satisfying the high requirements of the aerospace industry, can be achieved without using external tools.

[0020] Additional features and advantages will be described with reference to the drawings. In the description, reference is made to the accompanying figures that are

meant to illustrate preferred embodiments of the invention. It is understood that such embodiments do not represent the full scope of the invention.

Figure 1 illustrates schematically a mating assistance device according to the invention;

Figure 2 illustrates an exploded view of the mating assistance device according to the invention;

Figure 3 illustrates a schematically top view of the locking device;

Figure 4. illustrates a cross-sectional and top view of the mating assistance device and two electrical connectors in the unlocked position;

Figure 4a illustrates schematically a sectional view of the retentions means in the unlocked position;

Figure 4b illustrates schematically an electrical connector to be inserted into the mating assistance device;

Figure 5. illustrates a sectional view of the mating assistance device in which the electrical connectors are inserted, and wherein the locking device is in the unlocked position;

Figure 5a. illustrates a sectional view of the mating assistance device in the unlocked position;

Figure 6 illustrates a sectional view of the mating assistance device and two electrical connectors, wherein the locking device are partially moved from the unlocked position to the locked position;

Figure 7. illustrates a cross-sectional and top view of the mating assistance device and two electrical connectors, wherein the locking device is in the locked position;

Figure 7a. illustrates a sectional view of the mating assistance device in the locked position;

Figure 7b. illustrates schematically a sectional view of the retentions means in the locked position.

[0021] The present invention will now be described with reference to the attached figures. Various structures, systems and devices are schematically depicted in the drawings for purposes of explanation only and so as to not obscure the present disclosure with details, which are well known to those skilled in the art. Nevertheless, the attached drawings are included to describe and explain illustrative examples of the present disclosure. The words and phrases used herein should be understood and interpreted to have a meaning consistent with the understanding of those words and phrases by those skilled in the relevant art. No special definition of a term or phrase, *i.e.*, a definition that is different from the ordinary or customary meaning as understood by those skilled in the art, is intended to be implied by consistent usage of the term or phrase herein.

[0022] Figure 1 and Figure 2 represent a mating assistance device 1 according to the present invention. The mating assistance device 1 comprises a housing 3 and two locking devices 5, 7 movable with respect to the housing 3. In figure 1, the locking devices 5, 7 are illustrated

in the unlocked position relative to the housing 3.

[0023] The housing 3 is a one-piece housing, made of a molded plastic or a polymer material, and has the shape of a hollow beam with two opened-ends 9, 11 for receiving a terminal of an electrical connector (not represented in Figures 1 and 2) according to a direction of insertion of the electrical connectors inside the housing 3 and represented by the arrow A.

In another embodiment, not illustrated, a center region 4 of the housing 3 may be provided with flanges or a flange receiving region.

[0024] According to the first embodiment of the present invention, the locking devices 5, 7 are identical and are mounted on the housing 3 with mirror symmetry with respect to the center region 4. In another embodiment, the locking devices 5, 7 may be different from each other.

[0025] Each locking device 5, 7 has the form of a U-shaped bracket having a complementary shape to the housing 3, as it can be seen in Figure 2. Each U-shaped locking device 5, 7 is provided with a central portion 13 having an inner surface 12 from which extends two arms 14, 16 providing respectively two connector pushing elements 15, 17. The central portion 13 of each locking device 5, 7 can be used as a pushing-button by an operator for moving the locking devices 5, 7 from the unlocked to the locked position according to the locking direction represented by the arrow B. The locking direction B is perpendicular to the direction of insertion A.

[0026] As can be seen in Figure 3 which illustrates a top view of the locking device 5, the direction L1 of the length l1 of each arm 14, 16 (accordingly of each connector pushing elements 15, 17) is inclined with respect to a direction N1 extending normally from the inner surface 12 of the central portion 13. According to the first embodiment of the present invention, the inclination between the direction L1 and the direction N1 forms an angle α comprised between 5° and 15° .

[0027] The direction N1 of the normal extending from the inner surface 12 of the central portion 13 of the locking device 5 and the locking direction B are parallel, as illustrated in Figure 2.

[0028] Accordingly, the direction L1 of the length l1 of the connector pushing element 15, 17 is inclined with respect to the locking direction B with the angle α . Therefore, the trajectory of each connector pushing element 15, 17 from the unlocked position to the locked position is inclined with respect to the locking direction B according to the angle α .

[0029] The locking device 5 is mounted on the housing 3 such that when the locking device 5 moves from the unlocked to the locking position according to the locking direction B, the inclination of the connector pushing elements 15, 17 forming the angle α is oriented towards the center region 4 of the housing 3. As a consequence, the inclination of the connector pushing elements 15, 17 can provide the effect of moving and compressing each electrical connector towards the center region 4 of the housing 3 for sealing the electrical connectors together when

inserted into the housing. Thus, the altitude immersion requirement can be satisfied. The same applies for the second locking device 7.

[0030] Furthermore, the connector pushing elements 15, 17 of each locking device 5, 7 are respectively provided with inner surfaces 19, 21 facing each other. The surfaces 19, 21 of the connector pushing elements 15, 17 are provided with two protrusions 23, 25 protruding towards the inside 27 of the housing 3 when the locking devices 5, 7 are mounted to the housing 3. The shapes of the first and second protrusions 23, 25 of the locking devices 5, 7 are complementary to an interface of an electrical connector. The interface of the electrical connector will be further in Figure 4b.

[0031] The mating assistance device 1 is further provided with retentions means 28, 30, 32 configured to hold the locking device 5, 7 in the unlocked position and in the locked position respectively relative to the housing 3. The retentions means 28, 30 of each connector pushing element 15, 17 are longitudinal grooves 29, 31 provided on the surface 19, 21. The longitudinal groove 29, 31 are dimensioned to fit to a mating protruding element 33 of the retention means 32 of the housing 3, the protruding element 33 protruding towards the connector pushing element 15, 17. The retention means 28, 30, 32 are configured to provide a form-fit connection between the housing 3 and each of the connector pushing element 15, 17 in the unlocked position and in the locked position. In the unlocked position, as illustrated in Figure 1, the locking device 5, 7 is hold by form-fit connection between the retention means 30, 31 and the retention means 32, 33 of the housing 3. In the locked position, the locking device 5, 7 is hold by form-fit connection between the retention means 28, 29 and the retention means 32, 33 of the housing 3.

[0032] Each locking device 5, 7 and the housing 3 respectively comprise a handle 35, 37 for pulling the locking device 5, 7 from the locked position to the unlocked position. Hence, the mating of the electrical connectors can be reversed, therefore allowing an easy versatile use in comparison with a soldered or a bonded assembly for which have to be destroyed to disassemble.

[0033] Each locking device 5, 7 and the housing 3 further respectively comprise an opening with an undercut 39, 41 configured to allow an unmating of the electrical connectors, in particular by using an external tool.

[0034] The successive steps of the method for connecting electrical connectors with the mating assistance device 1 according to the present invention, are illustrated in Figure 4 - 7b. Elements with the same reference numeral already used in Figure 1, 2 and 3 will not be described in detail again but reference is made to their description above.

[0035] Figure 4 illustrates a state wherein two electrical connectors 43, 45 have been partially introduced into the mating assistance device 1 and the locking device 5, 7 are in the unlocked position - as further illustrated in Figure 4a.

[0036] The electrical connectors 43, 45 are inserted into the housing 3 of the mating assistance device 1 by the open-ends 9, 11 according to the direction of insertion A. At the step illustrated in Figure 4, the electrical connectors 43, 45 are not yet in contact and are separated by air 10 inside the housing 3.

[0037] In the step of Figure 4 and further illustrated in Figure 4a, the locking device 7 is held in the unlocked position by form-fit connection between the retention means 30, 31 of the connection pushing element 15 and the retention means 32, 33 of the housing 3.

[0038] As it can be seen in Figure 4b, each electrical connector 43, 45 is provided with latch means 47 on an interface 49. The latch means 47 comprises a ramp 51 and two protrusions 53, 55, here in the form of wedges 53, 55 adjacent each side of the ramp 51 perpendicular to the slope 51a of the ramp 51.

[0039] In Figure 5, the electrical connectors 43, 45 have been further inserted into the housing 3 such that they are now in contact with each other. Consequently, the air volume 10 is reduced compared to Figure 4. The locking devices 5, 7 are still in an unlocked position.

[0040] The displacement of the electrical connectors 43, 45 in the insertion direction A has moved the latch means 47 such that the second protrusion 25 of the connection pushing element 15 slides over the surface of interface 49 and is guided to the ramp 51. In particular, the dimensions of the first and second protrusions 23, 25 are adapted with respect to the dimensions of the latch means 47 of the electrical connectors 43, 45.

[0041] At the step of Figure 5, and as it can be seen in Figure 5a, the second protrusion 25 is then positioned between the wedges 53, 55 of the latch means 47. In this configuration, the locking device 5, 7 can still not be moved into the locked position in the locking position B, as the first and second protrusions 23, 25 are blocked by the wedges 53, 55.

[0042] At the step illustrated in Figure 6, the electrical connectors 43, 45 have been further inserted into the housing 3 according to the direction of insertion A by pushing the locking devices into the direction B. The air gap 10 is further reduced in comparison to the one illustrated in Figure 5.

[0043] The second protrusion 25 of the connector pushing element 15 slides further and partially behind the wedges 53, 55 on the side of the open-end 9, 11 of the housing 3.

[0044] Thus, by applying a force in the locking direction B on the central portion 13 of the locking devices 5, 7 the connectors 43 and 45 can be moved closer together without the need of an external tool.

[0045] As mentioned, the inclination of the direction L1 of the connector pushing element 15 with respect to the locking direction B allows a displacement of the connector pushing element 15 in the direction of insertion A when the locking device 5, 7 is moved from the unlocked to the locked position. According to this embodiment, the trajectory of the connector pushing element 15 from the

unlocked position to the locked position is inclined with respect to the locking direction B, preferentially at an angle α comprised between 5° and 15° . The inclination of the connector pushing elements 15, 17 of each locking devices 5, 7 are oriented towards the center region 4 of the housing 3 with respect to the normal direction N1 and the locking direction B. As a consequence, the inclination of the connector pushing elements 15, 17 provides the effect of moving each electrical connector 43, 45 towards the center region 4 of the housing 3 by means of the protrusions 23, 25 so that they can be compressed together to achieve the desired sealing. Indeed, the inclined trajectory of the protrusions 23, 25 with respect to the normal direction N1 and the locking direction B, have the effect of compressing the electrical connectors 43, 45 inwards the housing 3. At the step illustrated in Figure 6, the latch means 47 of each electrical connectors 43, 45 are separated by a distance X.

[0046] In Figure 7, the electrical connectors 43, 45 are mated and the locking devices 5, 7 are in their locked position.

[0047] By pressing on the central portion 13 (see Figure 7a) of the locking devices 5, 7 in the locking direction B, the locking devices 5, 7 can be moved into the housing 3 such that the electrical connectors 43, 45 are mated together. A little air 10 remains between the connectors 43 and 45. Only the elastomeric sealing cone devices from the male connector 45 are compressed into the front opposite cone recesses of the female connector 43. In comparison with the step illustrated in Figure 6, it can be seen in Figure 7 that the latch means 47 of each electrical connectors 43, 45 are now separated by a distance X-d, the distance d corresponding to the necessary dimension for having an efficient sealing between the two electrical connectors 43, 45. In this situation, the first and second protrusions 23, 25 are positioned behind the wedges 53, 55 on the interface 49. Thanks to the complementary shapes of the wedges 53, 55 and the protrusions 23, 25; the connector pushing elements 15, 17 and the latch means 47 realize a form-fit connection. As a result, the electrical connector 43, 45 cannot move against the direction A as it abuts against protrusions 23 and 25.

[0048] In this locked position of Figure 7 and as it can be seen in Figure 7a, the locking device 7 is held in the locked position by form-fit connection between the retention means 28, 29 of the connection pushing element 15 and the retention means 32, 33 of the housing 3.

[0049] In the locked position illustrated in Figure 7, the mating assistance device 1 allowed the electrical connectors 43, 45 to be sealed according to the immersion at low air pressure requirement.

List of reference number

[0050]

1 : mating assistance device
3 : housing

4 : center region
 5, 7 : locking device
 10: air volume
 9, 11 : opened end
 12 : inner surface
 13 : central portion
 14 : arm
 15 : connector pushing element
 16 : arm
 17 : connector pushing element
 19, 21 : inner surface
 23, 25 : protrusion
 27 : inside the housing
 28 : retention means
 29 : longitudinal groove
 30 : retention means
 31 : longitudinal groove
 32: retention means
 33 : protruding element
 35, 37 : handle
 39, 41 : opening with undercut
 43, 45 : electrical connector
 47 : latch means
 49 : interface
 51 : ramp
 51a : slope
 53, 55 : protrusion/wedge

A : insertion direction
 B : locking direction
 l1 : length of the arm
 L1 : direction of the length of the arm
 N1 : direction normal to the inner surface of the central portion
 X : distance
 d : distance
 α : inclination angle

Claims

1. A mating assistance device for electrical connectors comprising:

a housing (3) with at least one opening (9, 11) for receiving an electrical connector (43, 45), and
 at least one locking device (5, 7) movable between an unlocked and a locked position with respect to the housing (3), the at least one locking device (5, 7) further comprising at least one connector pushing element (15, 17), wherein the at least one locking device (5, 7), when moved from the unlocked to the locked position, is configured such that the at least one connector pushing element (15, 17) is displaceable in the direction of insertion (A) of an electrical connector (43, 45) into the housing (3).

2. The mating assistance device for electrical connectors according to claim 1, wherein the trajectory (L1) of the at least one connector pushing element (15, 17) from the unlocked position to the locked position is inclined with respect to the normal (N1) of the direction of insertion (A) of the electrical connector (45, 47) into the housing (3).

3. The mating assistance device for electrical connectors according to claim 2, wherein the trajectory (L1) of the at least one connector pushing element (15, 17) from the unlocked position to the locked position is inclined at an angle (α) comprised between 5° and 15° with respect to the normal (N1) of the direction of insertion (A) of the electrical connector (45, 47) into the housing (3).

4. The mating assistance device for electrical connectors according to one of the claims 1 to 3, wherein the at least one locking device (5, 7) has the form of a bracket (5, 7), in particular, the form of a U-shaped bracket having a configuration conforming to the shape of the housing (3).

5. The mating assistance device for electrical connectors according to claim 4, wherein the U-shaped bracket (5, 7) has a central portion (13) provided with an inner surface (12) from which extends two arms (14, 16) in the same direction (L1) such that the direction (L1) of the arm's length (11) is inclined with respect to a direction (B) extending normally from the inner surface (12) of the central portion (13).

6. The mating assistance device for electrical connectors according to one of the claim 1 to 5, wherein the housing (3) is a one-piece housing, in particular made of a molded plastic or a polymer material, and has the shape of a hollow beam with two opened-ends (9, 11) for receiving a terminal of the electrical connector (43, 45).

7. The mating assistance device for electrical connectors according to one of the claims 1 to 6, wherein the at least one connector pushing element (15, 17) of the at least one locking device (5, 7) is provided with one or more protrusions (23, 25), in particular two protrusions (23, 25), protruding towards the inside (27) of the housing (3) when in the locked position.

8. The mating assistance device for electrical connectors according to claim 7, wherein the shape of the one or more protrusions (23, 25) of the at least one locking device (5, 7) is complementary to latch means (47) provided on an interface (49) of the electrical connector (43, 45).

9. The mating assistance device for electrical connec-

tors according to one of the claims 1 to 8, further provided with two retentions means (28, 30, 32) configured to hold the at least one locking device (5, 7) respectively in the unlocked position and in the locked position respectively relative to the housing (3). 5

10. The mating assistance device for electrical connectors according to claim 9, wherein the retention means (28, 30, 32) are configured to provide a form-fit connection between the housing (3) and the at least one connector pushing element (15, 17) in the unlocked position and in the locked position. 10
11. The mating assistance device for electrical connectors according to claim 9 or 10, wherein the retentions means (28, 30, 32) comprises two recesses or grooves (28, 30) on the at least one connector pushing element (15, 17), in particular longitudinal grooves (29, 31), configured to fit to a protruding element (33) of the housing (3), the protrusion element (33) protruding towards the at least one connector pushing element (15, 17). 15 20
12. The mating assistance device according to one of the claim 1 to 11, wherein the at least one locking device (5, 7) and/or the housing (3) comprise at least one handle (35, 37) for pulling the locking device (5, 7) from the locked position to the unlocked position. 25 30
13. The mating assistance device according to one of the claims 1 to 12, wherein the at least one locking device (5, 7) and/or the housing (3) further comprise at least one opening with an undercut (39, 41) configured for allowing an unmating of the electrical connectors (43, 45), in particular by using an external tool. 35
14. The mating assistance device for electrical connectors according to one of the claims 1 to 13, wherein a center region (4) of the housing (3) is provided with flanges or a flange receiving region. 40
15. Method for connecting electrical connectors comprising an interface (49) provided with latch means (47), with the mating assistance device (1) according to claim 1 or 14, comprising the steps of: 45
 - a) inserting a terminal of the electrical connector (43, 45) into the housing (3) via the opened-end (9, 11) of the mating assistance device (1) in the direction of insertion (A); and 50
 - b) pushing the locking device (5, 7) from the unlocked to the locked position to thereby push the latch means (47) of the electrical connector (43, 45) further towards the center (4) of the housing (3) by the connector pushing element (15, 17) following the inclined trajectory (L1). 55

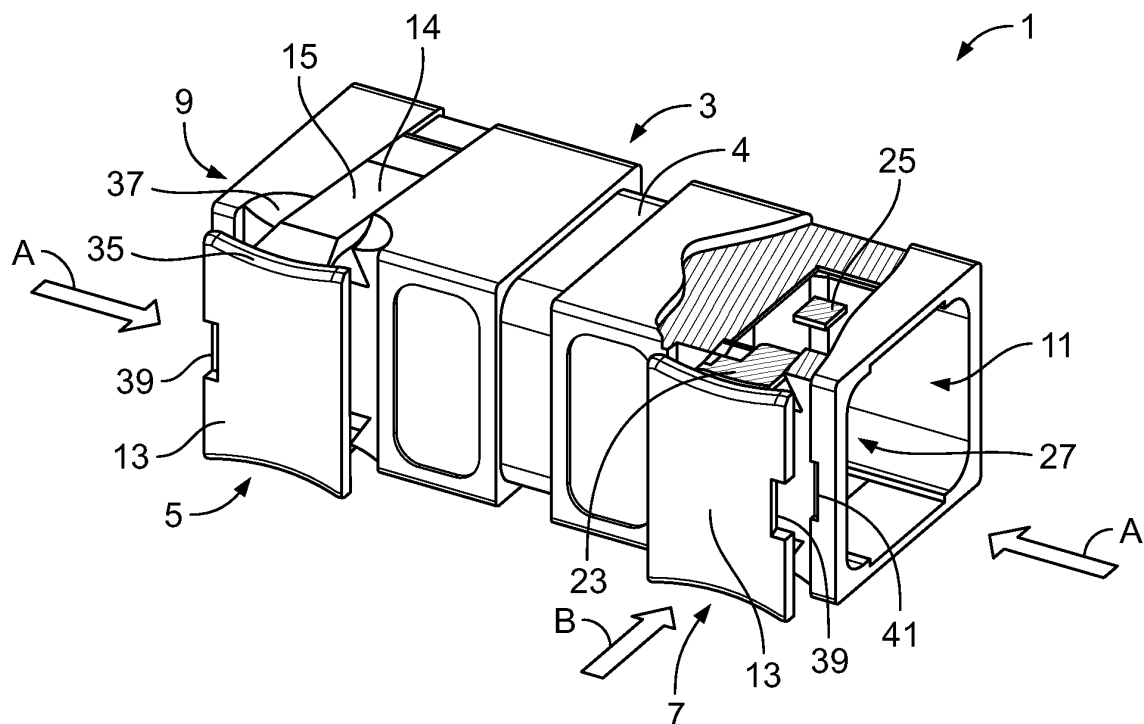


Fig. 1

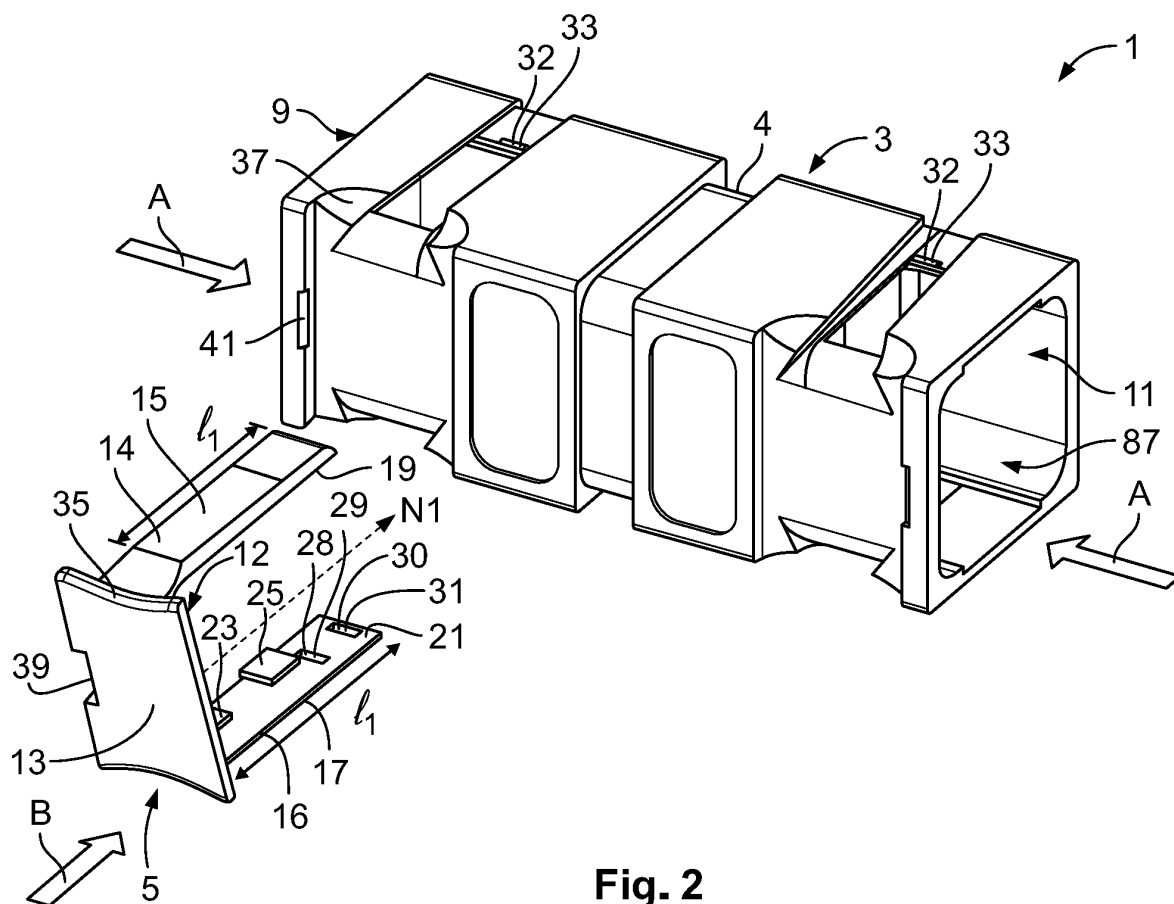
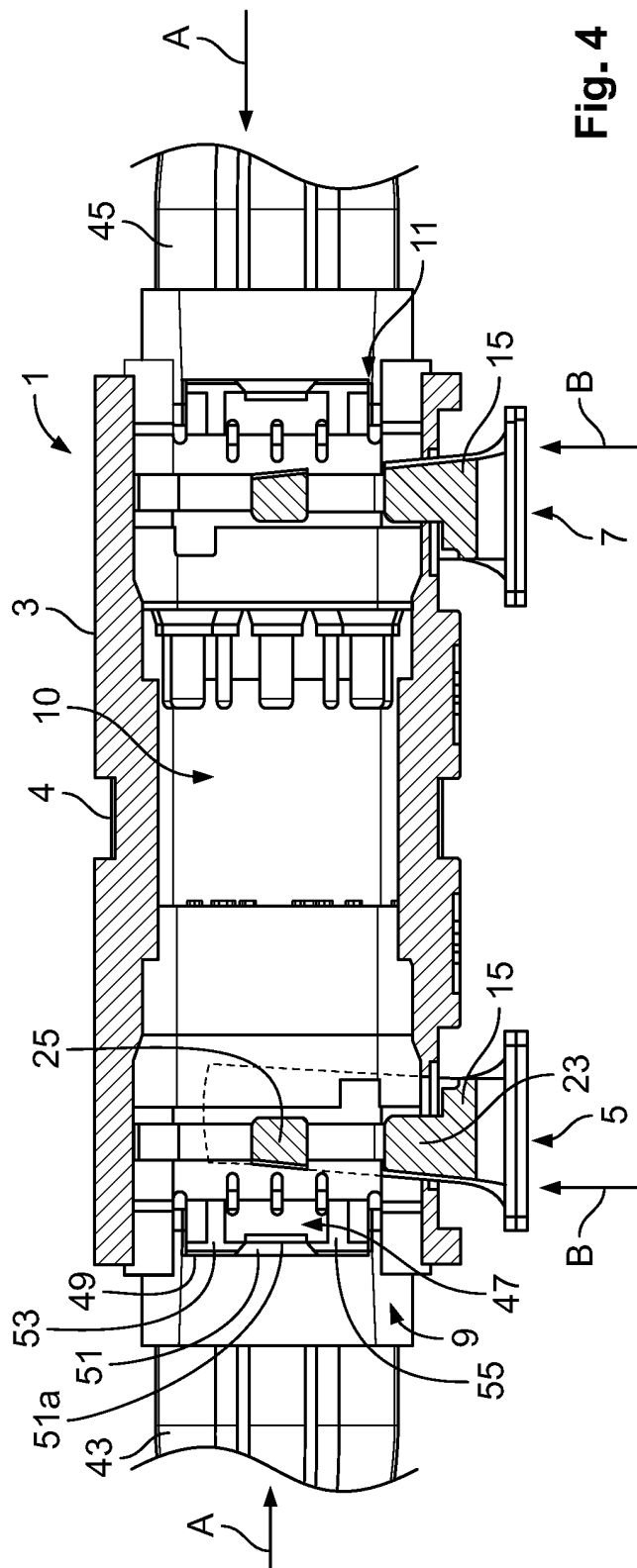
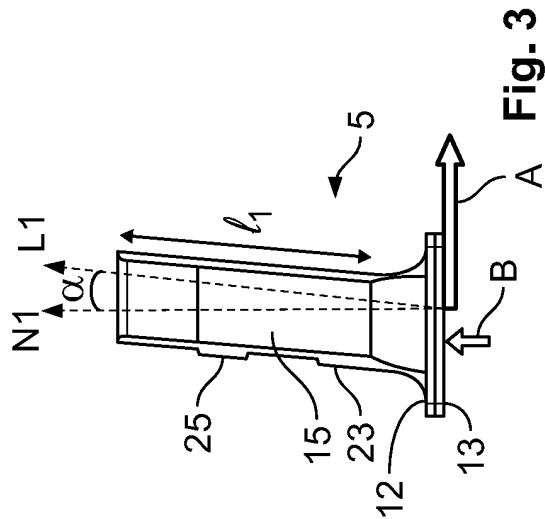


Fig. 2



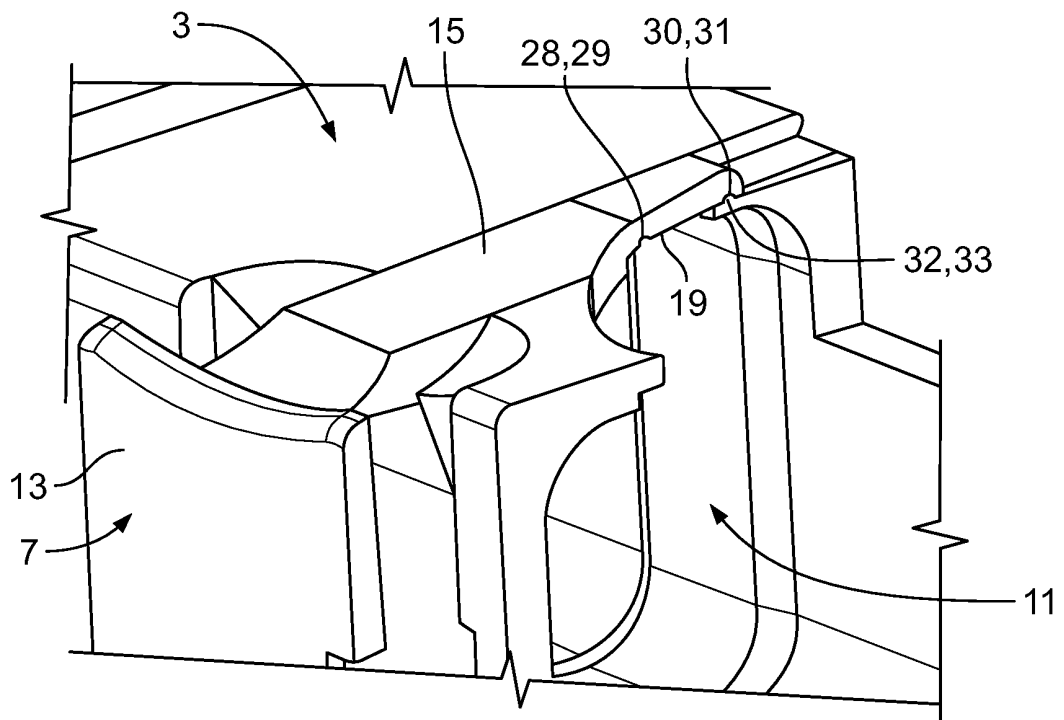


Fig. 4a

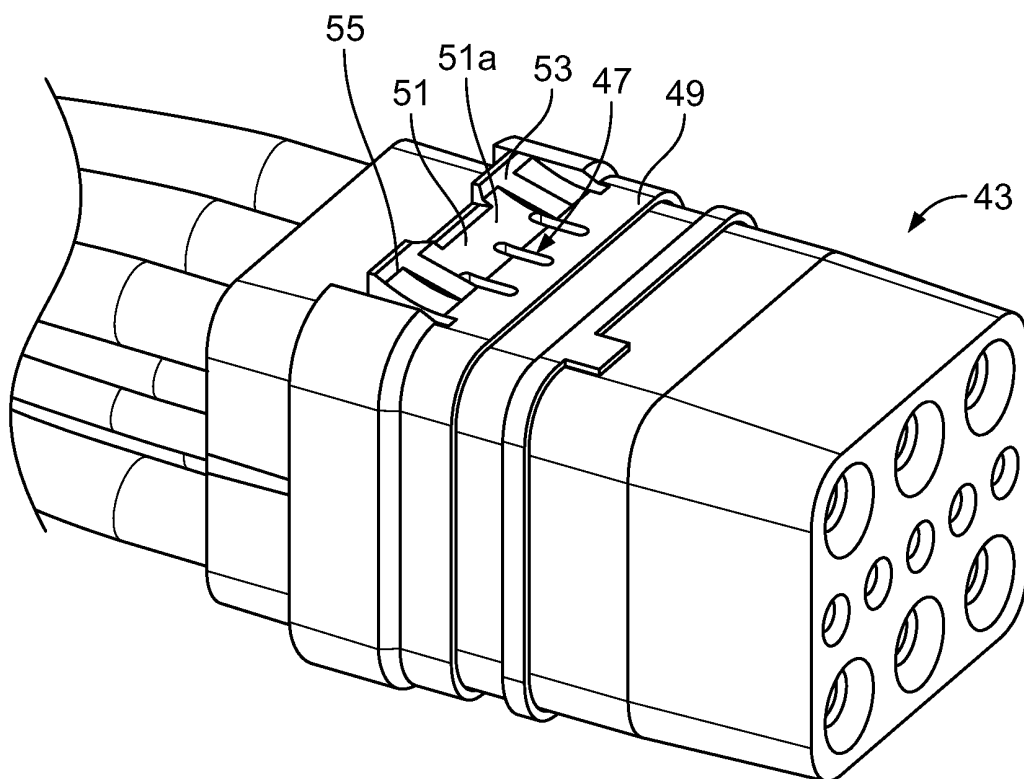


Fig. 4b

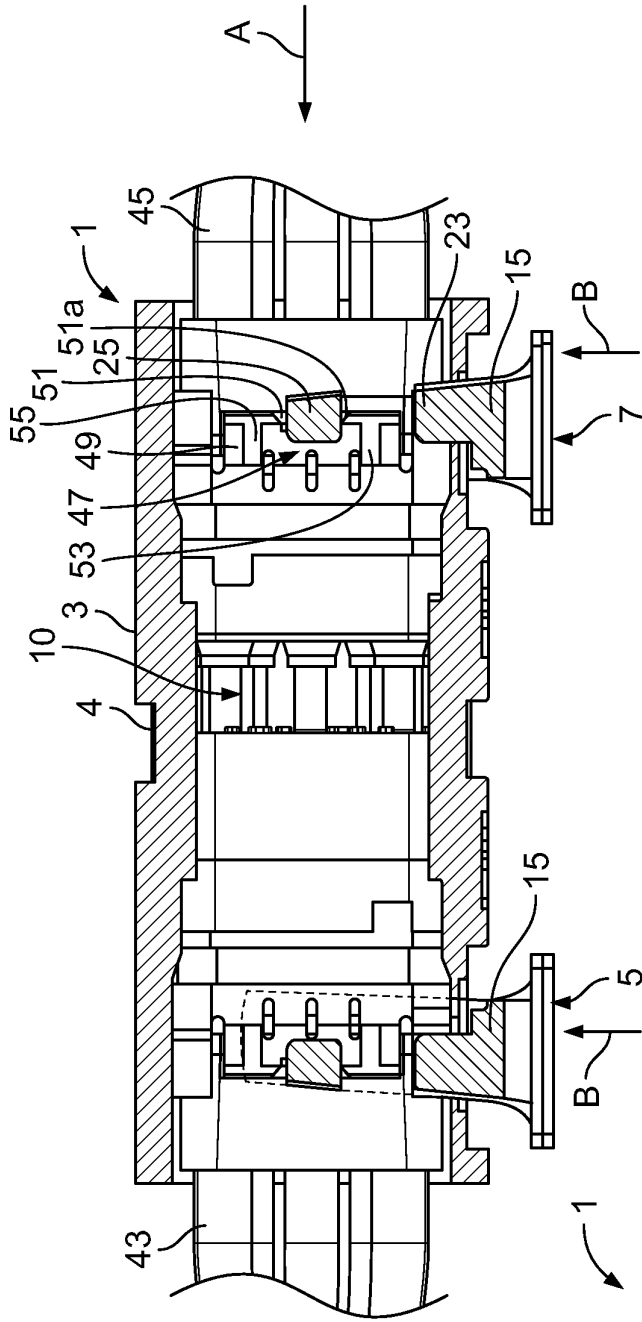


Fig. 5

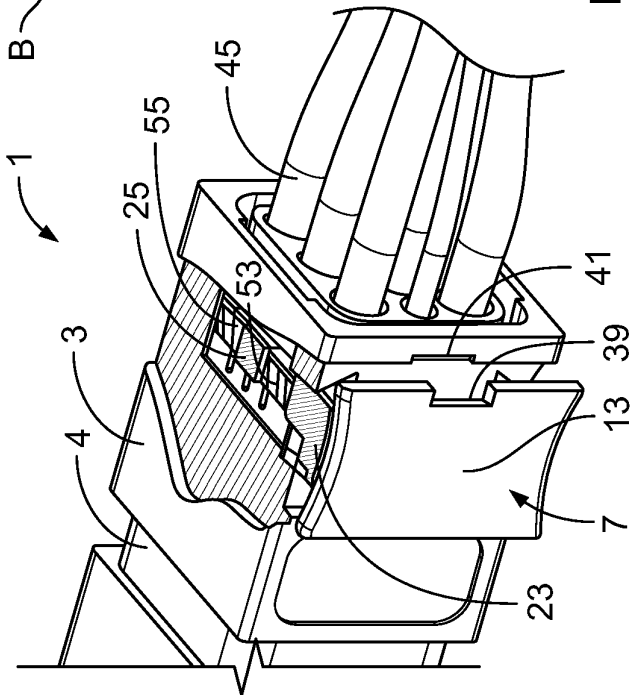


Fig. 5a

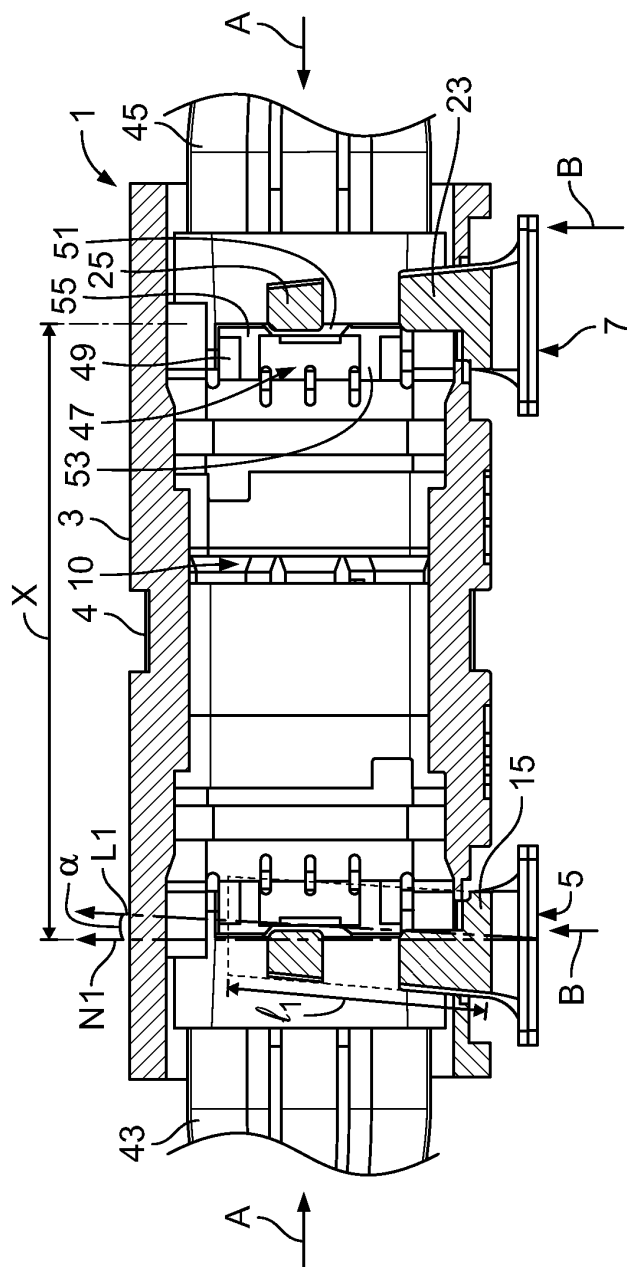


Fig-6

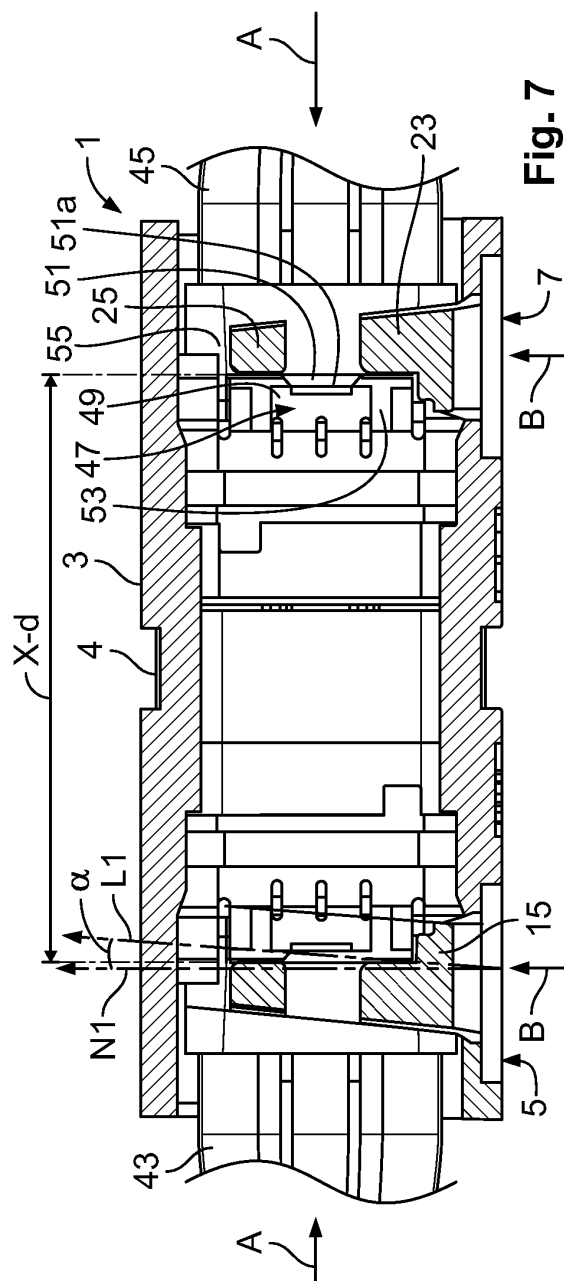


Fig-7

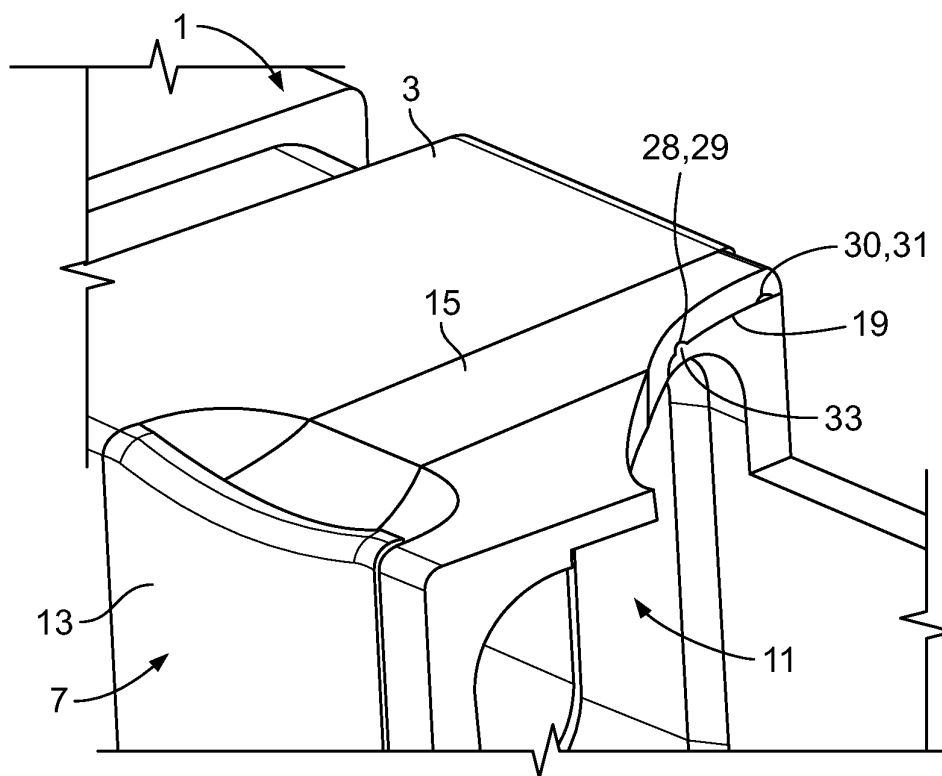


Fig. 7a

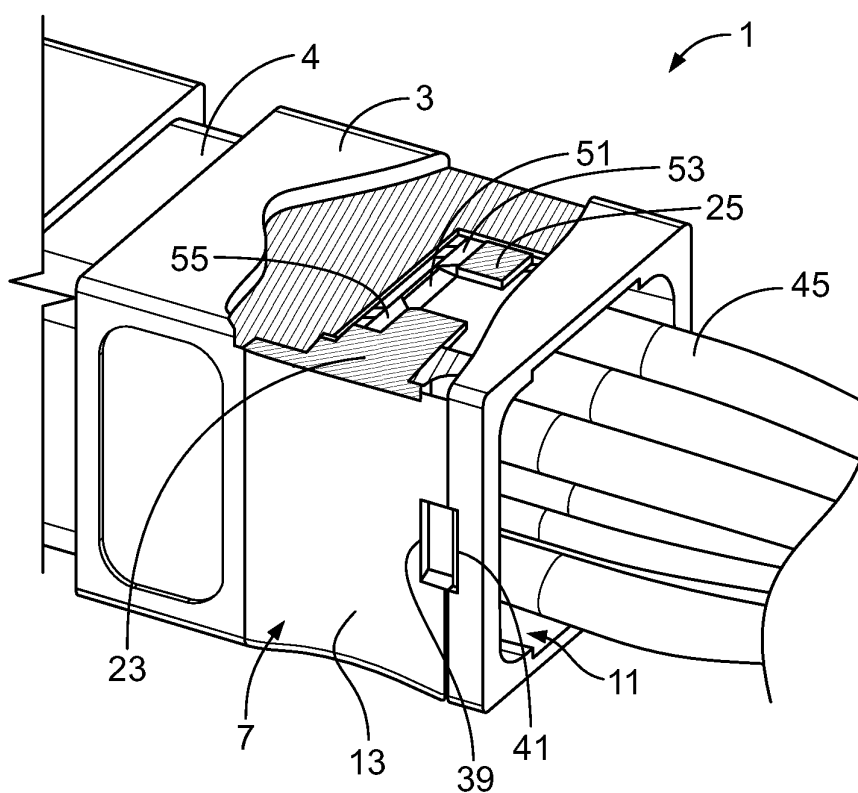


Fig. 7b



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 30 5421

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2003 031305 A (YAZAKI CORP) 31 January 2003 (2003-01-31)	1-3,6-8, 12,14,15	INV. H01R13/629
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